Section 7. Assessment of the Conservation Strategy's Effectiveness in Fulfilling the Plan's Purposes

7.1 INTRODUCTION

This Section of the Plan discusses the expected effectiveness of the operating conservation strategy in fulfilling the Plan's purposes of coordinating and facilitating Simpson's compliance with the federal ESA and providing the Services with the bases for authorizing Simpson to take Covered Species pursuant to an ITP and an ESP.

The analysis in this Section extends the assessment in Section 4 of the current conditions for the Covered Species in the area where the Plan will be implemented and the general assessment in Section 5 of the potential impacts of Covered Activities that may result in take and the types of effects that such take may have on Covered Species. This Section examines the effects of Covered Activities on habitat conditions and Covered Species with the Plan in place, the potential for those effects to result in actual take of Covered Species, the effectiveness of the conservation strategy in avoiding take wherever possible and, where it occurs, minimizing and mitigating its effects on the listed Covered Species, and the effectiveness of the conservation strategy in providing early conservation benefits for the unlisted Covered Species. The analysis also addresses how the conservation strategy meets the ITP and ESP requirements identified in Section 1.2.1. Specifically, this Section considers the following:

1. With regard to ITP requirements:

    a. Does the Plan minimize and mitigate, to the maximum extent practicable, the impacts of any incidental take of the Covered Species that could result directly from the Covered Activities or indirectly from the environmental effects of such activities?

    b. Does the Plan ensure that any such taking will not jeopardize the continued existence of the Covered Species?

2. With regard to ESP requirements:

    a. Would the benefits of the Plan for the ESP Species, when combined with the benefits for those species that would be achieved if it is assumed that conservation measures also were implemented on other necessary properties, preclude or remove any need to list those species? (The CCAA policy defines "other necessary properties" as those other properties, in addition to those that are the subject of the CCAA, on which conservation measures would have to be implemented in order to preclude or remove any need to list the covered species.)

b. Does the Plan ensure that the probable and indirect effects of any authorized take will not appreciably reduce the likelihood of survival and recovery in the wild of any species?

Generally, the Plan achieves these requirements by one or more of the following:

1. Avoiding an environmental “effect” that could cause take and result in impacts of taking,

2. Minimizing or mitigating a specific impact with specific measures designed to do so (both in nature and extent of impact), and/or

3. Providing other conservation benefits to the Covered Species.

Although the take avoidance and “minimize and mitigate” standards are legally applicable only to the ITP Species, the Plan applies both to the ESP Species as well. Application of these standards to the ESP Species helps to ensure that jeopardy is avoided. Moreover, the minimization and mitigation measures are themselves “conservation” measures that help to provide the early benefits for ESP Species as called for in the CCAA policy. Likewise, the ITP Species benefit from the measures applied for the conservation benefit of ESP Species; and such conservation benefits go beyond those required to minimize and mitigate the impacts of taking and avoid jeopardy to the ITP Species.

In addition to the measures designed to avoid or address specific impacts, the Plan includes measures designed to improve conditions for the Covered Species and/or their habitats overall. These additional measures provide a level of mitigation over and above the anticipated impacts of taking. Examples include the road decommission and upgrade measures (and the accelerated implementation of the measures) and the LWD recruitment measures. In addition, Simpson has proposed a special project: the fish bypass project that would open up anadromy to coho on one of the Mad River tributaries. While no “mitigation” credit is claimed for the project at this point, it could provide significant conservation benefits to the species if it proves successful. In any case, the information and insights gained from the project will provide a contribution toward the conservation of the Covered Species.

The conservation benefits provided by the additional measures also provide extra confidence that the Plan meets and in some cases exceeds the ITP and ESP standards that apply to each identified impact. Stated another way, the extra measures supply added assurance that a sufficient level of conservation is being provided to address any concern about the sufficiency of any particular measure to address the extent of a particular type of impact. Furthermore, the improvement in conditions that will result from these measures over and above that needed to meet the ITP “minimize and mitigate” standard will assure the achievement of properly functioning habitat and thereby contribute both to the recovery of the ITP Species and to efforts to preclude or remove the need to list the ESP Species.

The analysis that follows describes in detail how individual measures in the AHCP/CCAA will serve to:

1. Avoid take of the Covered Species within the Plan Area wherever possible, and

2. Where incidental take would occur,

    a. Avoid, minimize or mitigate the specific potential impacts of taking the ITP and ESP species caused by the Covered Activities within the Plan Area to the maximum extent practicable,

    b. Contribute to conservation benefits which, when combined with those benefits that would be achieved if it is assumed that the conservation measures also would be implemented on other necessary properties, would preclude or remove the need to list currently unlisted ESP Species in the future; and

    c. Avoid jeopardy to any Covered Species resulting from authorized take.

All possible impacts (individual and cumulative) of taking that may occur are examined, together with their relative significance to each species by category and in relation to all potential impacts and measures. Conservation benefits for all Covered Species are addressed in the evaluation of impacts and measures, with benefits for each ESP Species also summarized in a separate subsection for CCAA purposes.

7.2 TAKE AVOIDANCE, IMPACT MINIMIZATION AND MITIGATION, AND PROVISION OF CONSERVATION BENEFITS

This subsection analyzes the effectiveness of the Plan's conservation strategy in terms of avoiding take of Covered Species wherever possible and minimizing and mitigating impacts of authorized take to the maximum extent practicable. The analysis is organized by category of environmental effect on Covered Species and their habitat from Covered Activities as identified in Section 5:

- Potential for altered hydrology
- Potential for increased sediment input (overview)
- Potential for increased sediment from surface erosion
- Potential for increased sediment from mass wasting
- Potential effects on LWD recruitment
- Potential for altered thermal regimes and nutrient inputs
- Potential effects of barriers to fish and amphibian passage
- Potential for direct take from use of equipment

As discussed in Section 5, a number of potential causes of take and their resulting impacts were determined not to require HCP-specific conservation measures. In some cases, a particular cause of take or potential impact identified in Section 5 was determined not to be potentially significant on Simpson's ownership based on a site- or ownership-specific analysis,. In other cases, existing regulatory regimes ensure that the environmental effect that could result in take is sufficiently addressed and either mitigated adequately or avoided altogether. The latter also reflects another aspect of the Plan's purpose. As noted in Section 1, the Plan is intended to assist Simpson in meeting other legal mandates--such as protecting water quality in compliance with the Porter-Cologne Water Quality Control Act, and mitigating or avoiding all significant individual and cumulative environmental impacts of timber harvest under CEQA.

7.2.1 Potential for Altered Hydrology

7.2.1.1 Potential for Take and Other Impacts

The hydrology of a watershed is controlled by many complex interacting factors. Increases in runoff and peak flows could result from harvesting activity and road construction (either from individual harvesting activities or from the combined effects of multiple harvesting operations in a watershed that are temporally or spatially related). Such increases in runoff and peak flows could in turn cause some taking of Covered Species. Increased runoff in the early part of the rainy season could provide marginal benefit to the Covered Species by reducing water temperatures and providing more flow for migrating spawners. However, a harvesting-related increase in peak flow could increase the frequency that storm events mobilize channel substrates and damage developing eggs and alevins in redds and amphibian larvae and adults. Increased peak flows could also affect the survival of over-wintering juvenile salmonids by displacing them out of preferred habitats. Displacement of juveniles could cause take if the displacement impairs individual sheltering needs to the extent of killing or injuring individuals. In addition, increased peak flows and concentrated surface runoff could increase sediment input through mass soil movement. (See Section 6.3.2 for a description of how the conservation measures address increased sediment input.)

The impacts of such taking could include decreased survival rates and increased mortality in the early life stages of the Covered Species and cause temporary declines in their local populations.

7.2.1.2 Plan Measures and Strategy

As proposed, the Conservation Program's Riparian Management and Slope Stability Measures will act to reduce or avoid the impacts of altered hydrology and therefore avoid take or minimize and mitigate the impacts of any taking that results from altered hydrology (see Section 6.3.1) to the maximum extent practicable and contribute to conservation efforts benefiting ESP Species.

7.2.1.2.1 <u>Existing Limits on Potential Impacts</u>

The California FPRs have become increasingly restrictive over time, so Simpson considers the conservation benefits of the current rules as the base case. The Plan's conservation measures will augment existing FPRs that constrain the timing, location, and intensity of timber harvesting operations, and thus limit the hydrologic effects that might result from such operations. There are three rule Sections that are the primary sources of these constraints: those dealing with canopy retention along watercourses (14 CCR 916 et seq.), those restricting the size and spacing of even-aged management harvest units (14 CCR 913.1(a)(3) and (4)(a)), and those limiting harvest rotation age (14 CCR 913.1(a)(1) and 913.11 et seq.).

Under existing FPRs that define watercourse protection zone widths, in concert with provisions of the NSO HCP, approximately 12% (48,800 acres) of Simpson's ownership in the 11 HPAs is in riparian buffers. These Watercourse and Lake Protection Zones include no-cut areas within a defined riparian management zone and a minimum 70% post-harvest canopy retention outside of those zones. The net effect is that any hydrologic effect from "management" of this portion of the land base would be insignificant to non-existent.

The potential for even-aged management to alter hydrologic regimes is further constrained by FPRs that place strict limits on:

- The size of even-aged management units, which can be no more than 20 acres for ground-based yarding systems, 30 acres for aerial and cable systems, and 40 acres when justified according to specified criteria;

- The distance between even-aged management units, which must be "separated by a logical logging unit that is at least as large as the area being harvested or 20 acres, whichever is less, and shall be separated by at least 300 feet in all directions"; and

- The timing of the harvest of contiguous even-aged management units, which cannot occur unless regenerating stand in a previously harvested, adjacent clearcut unit is at least five years of age or five feet tall, and three years of age from the time of establishment on the site. (The net effect of this rule is that four to seven years must elapse between initiation of timber harvesting operations on adjacent even-aged management units, depending on how long it takes to complete timber harvesting operations and reforestation efforts and the growth rate of subsequent regeneration on the site.)

Long-term planning of timber harvesting operations in large tracts of mature timber in compliance with these temporal and spatial constraints becomes a complex challenge. The terrain typical of north coast forests, the need to consider road placement, appropriate logging systems, and other operational constraints, as well as varying stand ages and species compositions add complexity to the planning and further constrain Simpson's harvest schedule, meaning that it is not even possible to harvest at the pace that the minimum acreage, timing and spacing constraints would, in theory, allow. Even with the most optimistic operational assumptions, Simpson's planning efforts have demonstrated that the net effect of these constraints is that large tracts (~ 2000 acres) of relatively homogeneous rotation-aged timber cannot be completely harvested in less than 25 years, assuming a steady demand for forest products. Larger tracts typically encompass a range of both mature and younger age-classes that will extend this hypothetical cut-out period to near rotation age length.

Pursuant to the provisions of 14 CCR 913.11(a), which imposes requirements relating to Maximum Sustained Production, Simpson has an approved plan that limits its even-aged harvests to 50 year and older age classes. This provision further limits the frequency with which the hydrologic characteristics of any site can be altered. Even though intermediate treatments such as pre-commercial thinning and commercial thinning may result in transitory and minor changes in the hydrologic regime, this constraint on rotation age ensures that many decades of full hydrologic recovery follow any even-aged timber harvesting operation. Also, restrictions on the size and spacing of even-aged management harvest units, described above, effectively constrain the rotation age on many harvesting units well past the 50 year age class, with some stands reaching to 70 years of age or more before harvest, thus lengthening the cycle of disturbance significantly. Accordingly, existing requirements and Simpson's planning regime significantly limit the potential for increased runoff and peak flows and limit the risk that take could result from them.

In addition, measures proposed in this Plan will help to avoid take and, where take could occur as a result of harvest-related increased runoff and peak flows, minimize and mitigate the impacts of such taking and thereby contribute to conservation efforts benefiting the currently unlisted Covered Species.

7.2.1.2.2 Riparian Management Measures

The riparian measures specify no salvage in the inner zone of Class I and II watercourses and salvage in outer zone if non-functional criteria are met. This conservation measure maintains in-channel LWD and allows for further recruitment of downed LWD from the RMZ which will increase overwintering habitat for juvenile salmonids. The increased pool habitat will help avoid displacement or minimize the effects of displacement of juvenile salmonids caused by peak flows. The amphibian species do not necessarily benefit directly from the creation of pool habitat. The LWD in headwater streams function primarily to create suitable riffle habitat through the storing and sorting of sediment and to dissipate hydraulic energy during peak flows.

The riparian conservation measures were also designed to increase LWD recruitment though enhanced widths and canopy retention standards. On Class I watercourses and the first 200 feet of a Class II watercourse where it enters a Class I watercourse, no trees that are judged likely to recruit will be harvested. Over time, this conservation measure will increase the amount of LWD in streams, which will ultimately increase overwintering habitat for juvenile salmonids. Large woody debris recruitment will mitigate the impacts of displacing Covered Species that results from altered hydrology by providing increased habitat alternatives for juveniles that are displaced during a storm event.

7.2.1.2.3 Slope Stability Measures

Most past road related failures on steep streamside slopes are generally attributed to perched road fill loosely sidecast on steep slopes or concentrated road runoff discharging onto the fill. The slope stability conservation measures for SSS zones avoid building new roads or substantial upgrading on these features without the evaluation of a registered geologist. Upgrading or decommissioning of roads on SSS will address areas with perched unstable fill and sites with concentrated road runoff on fill material.

A benefit of tree retention with regard to slope stability on deep-seated landslides, headwall swales, and SMZs is the maintenance of forest canopy, which will preserve some measure of rainfall interception and evapotranspiration. Although these benefits of tree retention cannot be readily modeled across the entire Plan Area, such maintenance of rainfall interception and evapotranspiration is expected to contribute to acceptable slope stability conditions in some locations through partially mitigating high ground water ratios that may be management related.

7.2.1.2.4 Road Management Measures

Through the road upgrading and decommissioning program, the road network will be hydrologically disconnected from the watercourses. Inboard ditches collect surface runoff and intercept subsurface flows, then quickly route the water (and sediment) to streams, if hydrologically connected, thereby potentially producing higher and early peak flows. Through the use of decreased cross-drain and rolling dip spacing, and outsloping, as specified in the Road Plan, the amount of concentrated surface runoff at any point will decrease. The ditch water will be dispersed onto the forest floor where it can infiltrate and reduce the effects of increased peak flow caused by the road network.

Both the road management and decommissioning measures will significantly reduce the impacts of any operations-related altered hydrology by reducing the magnitude of peak flows and reducing the volume of sediment available for runoff during such events.

7.2.1.2.5 Harvest-related Ground Disturbance Measures

Timber harvest activities that compact or disturb the soil can reduce the infiltration capacity of soils and alter the process of subsurface water movement. Soil compaction can increase surface runoff and increase the rate which runoff reaches the watercourses as compared to subsurface flow. Site preparation measures are designed with seasonal operating limitations and minimized use of tractor-and-brushrake piling which can cause soil compaction during saturated soil conditions. There are also seasonal limitations for ground-based yarding operations with tractors, skidders, and forwarders which are intended to minimize soil compaction and risk of sediment delivery to watercourses. These Harvest-related Ground Disturbance Measures will significantly reduce the impacts of any operations-related to altered hydrology by minimizing soil compaction which can increase the magnitude of peak flows and the volume of sediment available for runoff during such events.

Altogether, these measures will work to minimize take of individuals of the Covered Species that could result from harvest-related increases in runoff and peak flows. Further, these measures will, to the maximum extent practicable, minimize and mitigate the impacts of any taking that may result from altered hydrology in the Plan Area and will contribute to conservation efforts benefiting ESP Species. They will reduce runoff and sediment transport, reduce the impacts of peak flow, reduce the amount of individual displacement that occurs during large storm events and improve the alternative habitat available for individuals that are still displaced during storm events. These measures will improve conditions over those that exist before the Plan, thereby contributing to the development and maintenance of properly functioning habitat for the Covered Species.

7.2.2 Potential for Increased Sediment Inputs

7.2.2.1 Potential for Take and Other Impacts

As described in Section 5.3, increased sediment inputs can reduce the quality of aquatic habitats for all six Covered Species through reduced depth of deep water habitats (primarily pools), increased embeddedness of gravel and cobble substrates, and the effects of chronic turbidity on the Covered Species.

7.2.2.2 Plan Measures and Strategy (Overview)

Simpson's conservation measures are designed in part to avoid taking that could be associated with increased sediment inputs related to the Covered Activities, by minimizing erosion and sediment-causing activities. However some potential exists for take of the Covered Species as the result of management related increases in sediment input. Therefore, the Plan provides for additional sediment reductions, beyond minimization measures associated with the Covered Activities. In particular, the Plan proposes to reduce the potential for existing sediment sources—legacy road conditions--to deliver sediment to Plan Area watercourses. The Road Management Measures relating to existing sediment sources will provide additional mitigation and compensation for take-related impacts to the Covered Species.

Simpson's operations under the Plan will reduce management-related sediment input into the stream network with the result of reducing associated impacts of increased sediment on the Covered Species. The conservation measures that will contribute to the sediment input reduction and associated reduction in impacts to Covered Species will be Riparian Management Measures, Slope Stability Measures, and Road Management Measures. The Riparian Management Measures and Slope Stability Measures are designed to reduce potential harvest related sediment inputs into the stream network through tree retention on slopes adjacent to watercourses and in MWPZs. The Road Management Measures are designed to reduce potential road related sediment inputs into the stream network, which represents a significant percentage of the sediment budget for most managed watersheds, through road repairs and upgrades.

7.2.2.3 Plan Measures and Strategy for Surface Erosion

Sediment production from erosion of hillslopes is assumed to be most important with regard to the sediment budget on slopes that are adjacent to watercourses, although erosion does occur higher on the hillslope and within harvest units. Eroded sediment can be delivered to watercourses through gullies or rills or through sheet transport processes.

The RMZ harvest prescriptions and harvest-related ground disturbance prescriptions described in Section 6.2.1/6.3.1 and 6.2.4/6.3.4, respectively, will reduce management related surface erosion and contribute to decreased sediment loads, which is intended to mitigate the possible effects of management related sediment input on the Covered Species.

7.2.2.3.1 Riparian Management Measures

The minimum width of RMZs on Class I (fish bearing) watercourses is 150 feet with 85% overstory canopy retention in the inner zone (50-70 feet depending on slope class) and 70% overstory retention in the remaining outer zone. Class II watercourses will have a minimum RMZ width of 70-100 feet with 85% overstory canopy retention in the inner zone (30 feet) and 70% on the remaining outer zone. Tier B, Class III watercourses will have an EEZ width of 50 feet with 100% hardwood retention and one conifer per 50 feet of stream length. These retention standards, with the inherently associated understory retention, will ensure that there will be almost no loss in total forest canopy in the inner RMZ along Class I and II watercourses and greatly increased canopy along Class III watercourses. This canopy coverage will impede grain detachment in these critical areas, where detached sediment would have relatively short transport distances to reach watercourses.

In addition to the canopy requirements, general RMZ conservation measures such as the limitations on equipment in the RMZs (EEZs), seeding and mulching of areas of ground disturbance larger than 100 square feet in Class I and II RMZs, and limitations on site preparation in RMZs and EEZs will also contribute to mitigating the effects of timber harvest on erosion processes on hillslopes that are adjacent to watercourses by preventing and remediating harvest related exposure of bare mineral surface soil.

Retention of trees that are judged to be critical to maintaining bank stability along Class I, II, III (Tier B) watercourses and retention of trees with roots that act as control points in Tier B Class III watercourses will contribute to mitigating accelerated bank erosion and down-cutting by maintaining a live root network that will increase total cohesion in the surface soil.

Other RMZ conservation measures, such as retention of trees that are likely to recruit and restrictions on salvage logging, may also contribute to mitigating the effects of management related increased sediment loads on the Covered Species to the extent that those trees and that downed wood do actually recruit to fish bearing watercourses. The beneficial role of large woody debris, boulders, and bedrock outcrops in creating channel structure are widely known and well documented (Bisson et al. 1987, Lisle 1986, Grant et al. 1990).

7.2.2.3.2 <u>Harvest-Related Ground Disturbance Measures</u>

The conservation measures outlined in the Harvest-Related Ground Disturbance section are specifically designed to minimize management related surface erosion. In particular, there are time period restrictions on silvicultural and logging activities when operations conducted during those time periods have a greater risk of sediment delivery to watercourses. Harvesting activities generally result in some level of ground disturbance. The time period restrictions allow those harvest activities with relatively low ground disturbance (and associated low risk of surface erosion), such as certain ground based yarding (not requiring constructed skid trails) and skyline and helicopter yarding, to be conducted during the winter period. Those harvest activities that can create more ground disturbance (e.g. skid trail construction, mechanized site preparation) are limited to the summer period only, with some activities (e.g. ground based yarding with tractors, skidders or forwarders) extending into the early spring or late fall, as well, if certain favorable climatic conditions occur. In addition, harvest related ground disturbances and exposure of bare mineral soil within harvest units will be minimized by way of carefully designed site preparation methods, limiting use of ground based yarding equipment that require constructed skid roads to slopes less than 45% (with some exceptions), preferential use of cable yarding systems versus ground based yarding systems, and water-barring of cable corridors where necessary. Evaluation of existing skid trails that have the potential to divert a watercourse and cause gully erosion or surface erosion will be evaluated on a site specific basis for repair during THP layout. All of these harvest related ground disturbance conservation measures will contribute directly to minimize management related surface erosion potential within harvest units by reducing harvest related ground disturbance and exposure of bare mineral soil.

Sediment production from the erosion of road surfaces is addressed in Section 6.2.3 and 6.3.3.

7.2.2.4 Plan Measures and Strategy for Mass Wasting

As discussed in Section 6.3.2, the slope stability conservation measures are twofold. First, the Plan includes default prescriptions. Second, the Plan provides for establishment of site-specific alternatives to the default prescriptions. These measures are designed to achieve the following conservation benefits.

Sediment production from mass wasting is most significant in riparian management zones (RMZs), steep streamside slopes, headwall swales, and active deep-seated landslides, as discussed in Sections 4.2, 5.3, and 6.3.2. These areas, with the exception of RMZs, are collectively referred to as Mass Wasting Prescription Zones (MWPZs) and are subject to specific slope stability conservation measures that are intended to reduce landslide occurrences and sediment production from landslides.

7.2.2.4.1 Slope Stability and Riparian Management Measures

The Slope Stability Measures will require tree retention in MWPZs, which areas are regarded as the most important with regard to sediment production from landslides. In SMZs, single tree selection harvest will be the most intensive silvicultural prescription permissible without geologic review. The RSMZ is no cut in the Coastal Klamath and Blue Creek HPAs. For the rest of the HPAs, the inner RSMZ band for Class I and Class II-2 is no cut and 85% canopy retention on the outer band. SSSs along Class I watercourses will be a maximum slope distance of 150 feet in the Smith River HPA, 475 feet in the coastal Klamath HPA, and 200 feet in all other HPAs. SSSs along class-II watercourses will be a maximum slope distance of 100 feet in the Smith River HPA, and 200 feet in all other HPAs. EEZs along Tier B, Class III watercourses will require retention of all hardwoods and an average of one conifer per 50 of stream length, plus all trees that are judged to be critical to bank stability. In high-risk headwall swales that are field verified as Shalstab areas, selection harvest will be the most intensive silvicultural prescription permissible. Active deep-seated landslides will be prescribed limited areas of 100% tree retention above their scarps and on the lower portions of their toes. Also, road construction and reconstruction will be limited in MWPZs.

Tree retention in the MWPZs is expected to maintain a network of live roots that will preserve total soil cohesion and contribute to acceptable slope stability conditions in these areas. Another benefit of tree retention with regard to slope stability is the maintenance of forest canopy, which will preserve some measure of rainfall interception and evapotranspiration. Although these benefits of tree retention cannot be modeled in a simple and practical manner across the entire Plan Area, such maintenance of rainfall interception and evapotranspiration is expected to contribute to acceptable slope stability conditions in some locations through partially mitigating high ground water ratios that may be management related.

Limited road construction and reconstruction in MWPZs is intended to avoid and reduce the undercutting and overburdening of sensitive hillslopes and also avoid unnatural concentration of storm runoff to these slopes. Additional road related conservation measures pertaining to road cut and road fill failures as well as watercourse crossing failures are discussed in Sections 6.2.3 and 6.3.3.

The Slope Stability Measures are intended to reduce management related landslide occurrences and contribute to decreased sediment loads, which is intended to mitigate the possible effects of management related sediment input on the Covered Species and the impacts of take from mass-wasting events.

The default slope stability prescriptions are based on a presumption that (a) carrying out harvest-related activities on any unstable feature that meets the AHCP/CCAA definitions poses a certain level of environmental risk to Covered Species (e.g., as a result of causing movement of the unstable area and delivery of sediment from unstable areas to watercourses) and (b) applying the default prescription to harvesting activities on that feature provides a sufficient level of risk avoidance or mitigation of such impacts to the Covered Species. The AHCP/CCAA also provides for the development of site-specific alternatives based upon unique site conditions that would minimize the risk of sediment delivery and provide a level of protection for Covered Species that equals or exceeds that provided by the default prescription. In other words, the alternatives would be designed to achieve the same conservation objective as the default. Therefore, applying the alternative will achieve protection and conservation benefits for Covered Species that is equal to or better than that provided by the default prescriptions.

These measures will minimize and mitigate impacts of any authorized taking resulting from mass wasting associated with Covered Activities to the maximum extent practicable, will contribute to the maintenance and development of properly functioning habitat in the Plan Area, and will contribute to conservation efforts benefiting ESP Species. The relative benefits of the minimization and mitigation of the impacts of mass wasting for the ESP Species compared to ITP Species is discussed in Section 7.5 below.

7.2.2.5 Plan Measures and Strategy for Road-Related Sediment

Road related erosion and mass wasting is known to be a significant contributor to the sediment budget in most managed watersheds. Eroded sediment can be delivered to watercourses through gullies or rills or through sheet transport processes from roads or through mass wasting. The Road Management Measures described in Section 6.2.3 and 6.3.3 will reduce road related sediment production.

7.2.2.5.1 Road Management Measures

The Road Management Measures will classify roads by necessity of use, prioritize road work units and site specific repairs, improve standards for road repairs and upgrades, improve standards for watercourse crossing and culvert repairs and upgrades, improve standards for temporary and permanent road decommissioning, and require personnel training program, all of which are described in Section 6.3.3. These and other road-related conservation measures will reduce road related sediment production, which is intended to partially mitigate the possible effects of management related sediment inputs into the stream network on the Covered Species.

Simpson has performed an analysis pertaining to the road-related sediment sources on its current ownership in the HPAs that would require treatment (e.g., stabilization of soil or other remediation to prevent road-related sediment-producing failures or mass wasting events). Simpson has categorized road sites that could require treatment into high, moderate, and low priority sites (based on the both the probability of delivery to watercourses and the sediment volume associated with such delivery). Simpson has estimated the volume of potential sediment associated with high and moderate sites to be approximately 6,440,000 cubic yards (see Appendix F). As part of the Road Management Measures, Simpson will carry out a road decommissioning and upgrading that ensure treatment of all of the high and moderate priority sites over the term of the Plan in order to avoid their potential delivery to riparian and aquatic areas. In addition, Simpson will provide for the expenditure of $2.5 million per year for the first 15 years of the Plan in order to accelerate implementation of the high and moderate priority site treatments. In Simpson's experience, the sites that will be treated pursuant to the Road Management Measures are located throughout the watersheds. To varying degrees, all the Covered Species are "downslope" from sites that will be treated; the Road Management Measures will therefore benefit all of the Covered Species with the relative benefit dependent on their different locations in the watershed.

Based on the original estimate of 6,440,000 cubic yards of sediment requiring treatment, $2.5 million/year for 15 years will result in approximately 47.5% of the overall volume being treated in the first 15 years of the Plan. This 47.5% equates to 3,057,000 cubic yards of sediment that could have otherwise delivered to streams on or adjacent to Simpson's ownership being removed within the first 15 years of the Plan. Accelerating the road-related sediment treatment of high and moderate sites will also decrease the rate of potential sediment delivery on an annual basis (Figure 7-1). This figure (and Figure F3-1) shows the road-related sediment component asymptotically approaching 3,000 cubic yards during the last decade of the Plan. This implies that the Road Management Measures will be 96.1% effective in controlling sediment associated with high and moderate priority treatment sites (See Tables F3-13 and F3-14, Road Upgrade Effectiveness Factor in Appendix F3).

The Road Management Measures will minimize and mitigate any impacts of take of Covered Species that may result from Covered Activities associated with Plan Area roads and will contribute appropriately toward conservation efforts intended to preclude or remove the need to list a currently unlisted Covered Species in the future. In addition, these measures will provide a significant benefit to all the Covered Species by significantly accelerating the natural recovery of the stream network and related habitats that may be negatively impacted by road-related impacts of prior management activities.

7.2.2.6 Plan Measures and Strategy for Minimizing Reduced Bank Stability

Erosion and mass wasting of watercourse banks can result from management operations. This can be in part due to increased peak flow intensity and duration as well as the reduction of root reinforcement of total soil cohesion. General riparian conservation measures are expected to partially mitigate the potential for stream bank erosion and instability.

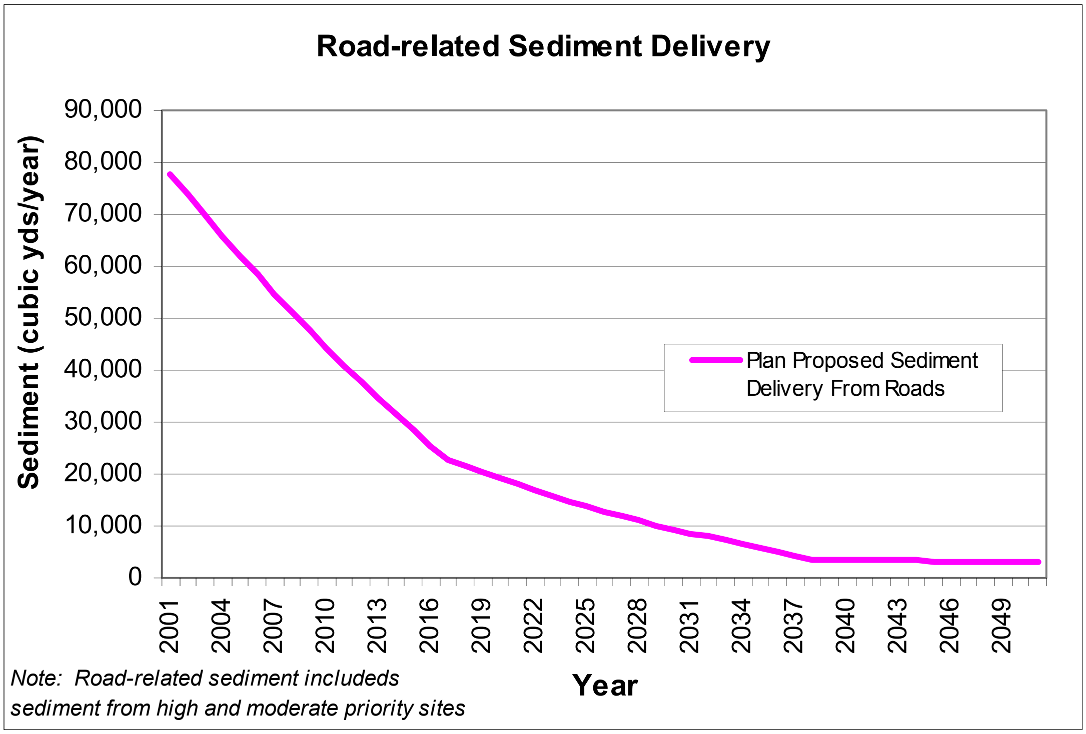

Figure 7-1. Sediment production estimates over the term of the Plan.

7.2.2.6.1 *Riparian Management Measures*

The riparian conservation measures for Class I and II watercourses that require 85% canopy retention in the inner RMZ and prohibit harvesting of trees that are likely to recruit, as well as the conservation measures for tier B Class-III watercourses that require retention of trees that are judged to be critical to maintaining bank stability and that act as stream control points will ensure that removal of trees and reduction of root reinforcement of soil shear strength is minimized to an acceptable level. These measures are expected to mitigate management related sediment inputs from stream bank instability, which is intended to contribute to mitigating the possible effects of increased sediment input to the stream network on the Covered Species.

Simpson has performed an assessment pertaining to proportional volume of sediment from various sources within the Plan Area that is likely to be delivered to the stream network under the Plan (see Appendix F). The aggressive road treatment program and other conservation measures will result in accelerated benefits with respect to sediment delivery to the stream network and the possible related adverse affects to all the Covered Species.

7.2.3 Potential Effects on Recruitment of LWD

7.2.3.1 Overview

Simpson's operations under the Plan will minimize and mitigate impacts associated with loss of LWD. The measures that will contribute here will be the Riparian Management measures and certain Slope Stability measures. Maintenance of riparian management zones (RMZs) provides several biological and watershed functions. In addition to functions such as maintaining the riparian microclimate and providing nutrient inputs, one of the most important functions of the RMZs is to provide for the recruitment of LWD. As noted in Section 5, LWD is recognized as a vital component of salmonid habitat. The physical processes associated with LWD include sediment sorting and storage, retention of organic debris, and modification of water quality (Bisson et al. 1987). The biological functions associated with LWD structures for the salmonid species include important rearing habitats, protective cover from predators and elevated stream flow, retention of gravels for salmonid redds, and regulation of organic material for the in-stream community of aquatic invertebrates (Murphy et al. 1986; Bisson et al. 1987). Decreased supply of LWD can result in increased vulnerability to predators, reduction in winter survival, reduction in carrying capacity, lower spawning habitat availability, reduction in food productivity and loss of species diversity (Hicks et. al. 1991 as cited by Spence et. al. 1996).

In headwater streams, LWD, which can be functional at much smaller sizes, is known to dissipate hydraulic energy, store and sort sediment, and create habitat complexity (O'Connor and Harr 1994). Creating and providing cover for pools, a primary function of LWD for salmonids, may contribute limited conservation benefits to the headwater amphibian species since torrent salamanders and larval tailed frogs prefer riffle habitats (Diller and Wallace 1996 and 1999; Welsh et. al. 1996). The primary benefit of LWD to the amphibians is the creation of suitable riffle habitat through the storing and sorting of sediment. In addition, LWD will often form a dam composed of coarse sediment and small woody debris through which water percolates. In streams that are otherwise too embedded with fine sediments to be used by torrent salamanders, this appears to form the only habitat that still supports the species (Diller, pers. comm.). There is circumstantial evidence that these same sites are utilized for egg laying by tailed frogs, but searching such sites is too destructive to adequately investigate the phenomenon (Diller, pers. comm.).

7.2.3.2 Potential for Take and Other Impacts

Simpson does not remove LWD from watercourses or salvage from the inner zone of RMZs. In Simpson's view, as defined in the ESA, incidental take is not caused by the harvesting of standing trees that are potential sources of future LWD (i.e., trees located in a position that, if left in place, could grow to a sufficient size to perform LWD functions when they are recruited into a watercourse).

Harvesting that results in a failure to allow long term natural recruitment of wood for future habitat would not cause a "take" as it does not constitute a significant habitat modification or degradation which actually causes the death or injury of fish or wildlife by significantly impairing essential behavioral patterns (any injury that might occur would be so far into the future as to be speculative). Nevertheless, Simpson recognizes that such an action has the potential to result in potentially significant long term negative impacts other than "take" on future habitat conditions and the ability of the local salmon stocks, steelhead, cutthroat trout, and, to a lesser degree, the amphibians, to maintain and recover. In addition, Simpson has identified certain areas within the Plan Area that are relatively low in functional LWD as a result of past harvesting practices (e.g., complete harvest in riparian areas, extensive removal of in-stream LWD).

Long term reductions in LWD can result in less stream complexity and reduce the amount of high quality rearing habitat for salmonids and other fish species. LWD in a watercourse provides a sediment storage and sorting function that benefits both fish and amphibian species. A decline in pool density, pool depth, in-stream cover, and gravel retention are likely to result from LWD losses. Harvesting practices that result in low levels of LWD may, accordingly, impact the growth, survival, and total production of the Covered Species.

7.2.3.3 Plan Measures and Strategy

For purposes of developing and prioritizing conservation measures for this Plan, Simpson has (a) addressed the potential environmental impacts of removing possible sources of future LWD as if they are comparable in relative significance to the potential impacts of actual take and (b) included in the proposed conservation strategy a number of measures designed to minimize and mitigate these impacts and contribute significant conservation benefits to the Covered Species.

7.2.3.3.1 <u>Riparian Management Measures</u>

The minimum width of RMZs on Class I (fish bearing) watercourses is 150 feet with 85% overstory canopy retention in the inner zone (50-70 feet depending on slope class) and 70% overstory retention in the remaining outer zone. However, probably the most important measure relative to the potential recruitment of LWD is that no trees will be harvested that are judged likely to recruit. There are a variety of criteria that will be used to make this judgment including, but not restricted to, distance from the stream, direction of the lean, intercepting trees and potential for stream undercutting.

The abundance and distribution of LWD in a stream is a function of six fundamental variables: tree growth, tree mortality, bank erosion, mass wasting, stream transport and decay. Since all of these factors are likely to vary from one region to another and some of the variables are difficult to estimate over large areas (e.g. relative contribution of LWD through tree mortality, windthrow, bank erosion and mass wasting), predicting future supply of LWD in a stream is highly problematic. A potential solution is to simplify the process by using site potential tree height with windthrow and tree mortality as the only recruitment mechanisms. Using this approach, the potential future recruitment of LWD can be crudely estimated based on a variety of different published source-distance curves for coarse woody debris (Murphy and Koski 1989; McDade et al. 1990; Van Sickle and Gregory 1990; Reid and Hilton 1998). The different studies generated source-distance curves based on both empirical and model-based studies from different regions and it is difficult to know which curve would be most applicable to Simpson's region. Reid & Hilton (1998) were chosen as being the most appropriate for this region and did the evaluation built around a "median" source-distance curve. Six variables were considered in the evaluation: RMZ inner zone width, RMZ total width, managed potential tree height, site potential tree height, site index 100, and site index 120. A minimum buffer width of 150 feet used was with inner zones of 50 and 70 feet on Class I watercourses and an inner zone of 30 feet on Class IIs with total RMZ widths of 70 and 100 feet. For Class I watercourses, the total RMZ provided for 99 and 88%, respectively, of the total potential recruitment for managed and site potential tree height for site index 100. For site index 120, the attainment was 98 and 84%, respectively, for managed and site potential tree height. (There was no difference in the estimate attainment for 50 versus 70 foot inner zones.) On the second order Class IIs (100 foot total RMZ width), the attainment was 95 and 73%, respectively, for managed and site potential tree height for site index 100, and 90 and 67%, respectively, for site index 120. On the first order Class IIs (70 foot total RMZ width), the attainment was 85 and 57%, respectively, for managed and site potential tree height for site index 100, and 78 and 52%, respectively, for site index 120.

However, this analysis does not account for the fact that most of the trees that will be harvested are those on the outer edge of the riparian buffer that have the lowest potential to be functional in the stream since only the upper portion of the tree would reach the stream. Excluding geologic processes (see below), the riparian conservation measures will insure that all the trees with the greatest potential for significant LWD function (e.g. LWD recruited by fluvial processes, windthrow or tree mortality with sufficient size and proximity to the stream that it can influence fluvial processes and provide cover for fish) will be retained. The small proportion of trees that will be harvested within the RMZs will not only have a very low probability of contributing significant LWD to the stream, but by removing some trees, the surrounding trees should have increased growth with even greater potential functionality in larger Class I watercourses. Therefore, Simpson concludes that the riparian conservation measures for Class I watercourses will provide for fully functional LWD recruitment rates and may actually enhance LWD recruitment compared to natural rates from no cut buffers.

As noted above, LWD performs many similar functions in Class II watercourses, but also has some unique functions in Class II watercourses, particularly in the smaller headwater streams. The piece size that is functional tends to decrease as the stream and associated hydraulic energy of the stream decreases. In addition, pool habitat, which is probably not a limiting habitat type for the amphibians, is more likely to be formed by bedrock and boulders in small confined channels. Finally, there is little evidence for a reduction of LWD in most Class II watercourses in the Plan Area. Instead, past logging practices may have resulted in an overabundance of LWD in many of these smaller streams. As a result, LWD recruitment is less of a conservation priority in these streams and much of the benefit of the Class II RMZ is thought to be for the maintenance of microclimate and bank stability. Even so, it is still important that there are adequate sources of LWD for these channels into the future.

As described above, using an analysis of managed and site potential tree height with windthrow and tree mortality as the only recruitment mechanisms, the minimum buffer width of 70-100 feet on Class II watercourses will reduce the total number of potential trees recruited by an estimated 5-48% relative to maximum potential rate depending on the RMZ width and other assumptions made. However, this analysis does not take into account the mechanism by which LWD becomes functional in 1st and 2nd order channels (most Class II watercourses). These channels often have an inner gorge feature with a distinct break in slope, which limits recruitment of trees from outside this zone. Trees from outside the inner gorge often end up spanning the channel and do not reach the streambed until they have completely decayed. In contrast, trees that are growing close to the channel and/or within the inner gorge have much greater potential for at least some portion of the tree to be incorporated into the channel. Simpson's headwater amphibian studies also indicate that small woody debris is often functional in Class II watercourses. Most of the smaller material comes from tree branches and roots, which originate from trees near the watercourse. Therefore, even though the buffer widths provide for approximately 5-48% of the potential maximum recruitment, we believe the majority of the functional LWD will be provided by the Class II RMZs along with maintaining bank stability and the riparian microclimate (see Appendix C1).

The preceding discussion of future LWD recruitment potential from RMZs has focused on the proportion of trees that will be available for recruitment, but it is also necessary to assess both the number (density) and size of trees that will be retained in the RMZs. As part of the riparian conservation measures, there will only be a single entry into RMZs to harvest trees during the term of the Permits for both Class I and II watercourses. Only a small proportion of the trees within RMZs will be harvested (85% retention in inner zone and 70% in the outer), and those remaining will continue to age following removal of the adjacent stands. Therefore, the future age of RMZs can be projected, based on the current age of RMZs at the time the Plan is being developed.

Figure 7-2 indicates that RMZs will be increasing in age throughout the term of the Plan, so that by the end of the permit period over one third of the stands comprising the RMZs will be greater than 100 years old and the remainder will be between 51-100 years. Given that the level of harvest will be lighter than a commercial thinning, good growing conditions are expected for trees in the RMZs following harvest of the adjacent stand. At age 100 in a typical RMZ in the redwood zone, there will be approximately 120 trees per acre, with 12% of the trees > 36" DBH. A few trees will exceed 48" DBH and the tallest trees in the stand will be about 170 feet tall. Under exceptional conditions (little competition, very good soils, lots of light, water and nutrients) a 100 year old redwood can exceed 5 - 6 feet in diameter. In the more interior Douglas fir/hardwood zone, growth will not be quite as rapid, but there will be approximately 130 trees per acre, with 6% of the trees > 36" DBH. An occasional tree will exceed 48" DBH and the tallest trees in the stand will be about 180 feet tall.

7.2.3.3.2 Slope Stability Measures

Most of the Slope Stability Measures are designed to minimize management induced sediment inputs into Plan Area watercourses and to contribute conservation benefits for both ITP and ESP Species. However, geologic processes can be important mechanisms to provide LWD into streams, and in some situations, it may be the predominate mechanism by which LWD reaches streams. In particular, shallow rapid landslides have the potential to deliver large amounts of LWD when they form in steep streamside slopes or inner gorges. In addition, debris torrents from small headwater Class II and III watercourses can be an important source of LWD when they empty directly into Class I or large Class II watercourses. This latter phenomenon has not been frequently observed within the most of the Plan Area, but there are isolated areas where debris torrents are sufficiently common to be a potential important source of LWD.

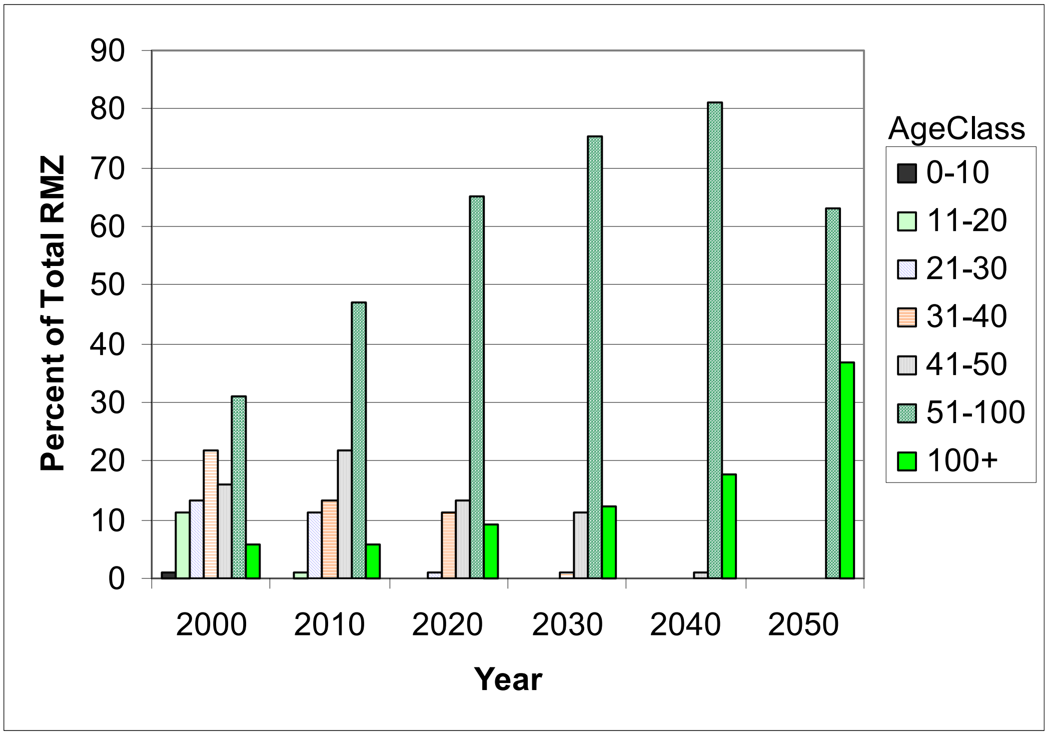

Figure 7-2. Projected age distribution of Class I and Class II RMZs over the term of the Permits.

The slope stability management zones (SMZs) occur outside of RMZs in areas (inner gorges and steep streamside slopes, headwall swales and toes of deep-seated landslides) that have been determined to be prone to shallow rapid landslides (see Section 6.2.2 and 6.3.2). As noted above, the primary objective of the SMZ is to minimize the likelihood of management-induced landslides. However, landslides do occur in these areas with or without management activities, and the SMZ conservation measures will insure that when a landslide does occur, it has the potential to deliver large amounts of LWD to the stream.

7.2.4 Potential for Altered Riparian Microclimate

7.2.4.1 Potential for Take and Other Impacts

The riparian microclimate is potentially important to the adult forms of the amphibian species. (The riparian microclimate has indirect effects on the salmonids and aquatic forms of the amphibians through alteration of water temperature, which will be discussed in the following Section.) Loss of riparian overstory canopy through timber harvesting could result in increased levels of incident solar radiation during the day and reduced thermal cover at night. It would also increase exposure to wind in the riparian areas with the overall net effect of increasing daily fluctuations in air temperature and relative humidity. In addition, increased coarse sediment inputs from Covered Activities, particularly when it occurs in the form of debris torrents, can result in widening of the channel and loss of streamside vegetation. Just as in overstory canopy loss, this has the potential to alter the riparian microclimate by increasing daily fluctuations in air temperature and relative humidity. It is unlikely that increases in air temperature with corresponding decreases in relative humidity during the day would directly impact the amphibian species, because the adults are not surface active during the day. However, the corresponding drying effect of increased air temperature and decreased relative humidity could result in the loss of some daytime refugia habitat and nighttime foraging sites. It is also possible that the reduction of thermal cover at night may impact the ability of adults to forage at night.

7.2.4.2 Plan Measures and Strategy

7.2.4.2.1 Riparian Management Measures

The minimum width of RMZs on Class I (fish bearing) watercourses is 150 feet with 85% overstory canopy retention in the inner zone (50-70 feet depending on slope class) and 70% overstory retention in the remaining outer zone. Class II watercourses will have a minimum buffer width of 70-100 feet with 85% overstory canopy retention in the inner zone (30 feet) and 70% on the remaining outer zone. These retention standards will insure that there will be almost no loss in canopy in the critical inner zone where microclimatic effects would have the greatest potential to directly impact the amphibians or indirectly impact the salmonid species. There will be an immediate net reduction of canopy cover of approximately 15-20% following timber harvest in the outer zone, which will be replaced within 5-10 years by recovery of the remaining tree crowns. On average, approximately 1000 feet of watercourse would be influenced by the average-sized harvest unit (currently about 25 acres) if the unit surrounds or is adjacent to a watercourse.

While studies done in other areas indicate that microclimatic edge effects can be detected as much as 240 meters (787 feet) from the edge of a clearcut (Chen 1991), the greatest attenuation of edge effects on microclimatic changes occurs within the first 30 meters (98 feet) of the buffer (Ledwith 1996). These studies reported above were done in areas with much higher extremes in air temperatures, so it is assumed that the cool coastal climate associated with most of the Plan Area will greatly ameliorate these potential impacts. In addition, the potential impacts to the microclimate would be highly localized and short-term given the rapid rate of regrowth of vegetation in the Plan Area. Although little direct data have been collected to support this conclusion that microclimatic effects should be minimal, there is strong circumstantial evidence for the conclusion based on the occurrence of the amphibians in streams that had little or no protection under past unregulated harvesting. As described in Section 4.3.11 and Appendix C11, presence/absence surveys indicated that southern torrent salamanders and tailed frogs were found in 80.3 and 75.0%, respectively, of sampled Plan Area streams in stands that ranged from recent clearcuts to mature second growth (Diller and Wallace 1996 and 1999). In contrast, studies done in more interior areas to the east of the Plan Area indicated that only 11% of streams in young stands contained both species, 50 and 56%, respectively, had torrent salamanders and tailed frogs in mature stands and 70 and 81%, respectively, of streams in old growth forests had both species (Welsh 1990). It is not likely that sediment inputs or other direct impacts to the streams in the Plan Area were less relative to the interior streams, so the best explanation for the difference in the study results was due to climatic differences. Simpson's assumption is that if these species could survive in streams with no or only minimal protection in the past, then any short-term minor microclimatic changes under the planned riparian conservation measures will have no measurable biological effect.

7.2.4.2.2 Slope Stability and Road Management Measures

The Slope Stability Measures are designed to minimize management induced sediment inputs into watercourses throughout the Plan Area, but of particular importance are the road management measures designed to reduce the likelihood of road-related mass wasting. Observations since 1992 as part of Simpson's property-wide amphibian studies indicated that all of the known damaging debris flows in headwater streams have been related to road failures. The commitment associated with the road conservation measures is projected to result in the treatment of more than 47% of the sediment from high and moderate probability future road failures sites within the first 15 years of the Plan and treat all of the high and moderate sites by the completion of the Plan will greatly reduce the potential negative impacts of road-related mass wasting events. These measures will minimize and mitigate the impacts of any taking that will occur associated with altered microclimate. Further, these measures will contribute conservation benefits for both ITP and ESP Species by helping to maintain and improve properly functioning habitat.

7.2.5 Potential for Altered Water Temperature

7.2.5.1 Potential for Take and Other Impacts

Loss of riparian overstory canopy through timber harvesting and increased coarse sediment inputs from Covered Activities could result in alteration of the riparian microclimate as described above. However, changes in the riparian microclimate will also result in corresponding changes in the daily and seasonal water temperature regime. In addition, both reduction of overstory canopy and increased coarse sediment inputs can result in altered water temperature through direct mechanisms. Open sky along the solar path will allow direct sunlight to warm the water during the day (Chamberlain et al. 1991) and radiate heat at night, while increased sediment inputs that results in aggradation will result in a wider and shallower channel that gains and losses heat more rapidly.

Increases in water temperatures during summer can have negative impacts on the salmonids (Beschta et al. 1987) as well as the amphibians. Potential impacts to salmonids are a reduction in growth efficiency, increase in disease susceptibility, change in age of smoltification, loss of rearing habitat, and shifts in the competitive advantage of salmonids over non-salmonid species (Hallock et al. 1970; Hughes and Davis 1986; Reeves et al. 1987; Spence et. al. 1996). In some situations, increased light levels and increased autotrophic production can also have a positive effect through an increase in food production and higher growth rates. Although the specific mechanisms are more poorly understood, many of the same physiological or ecological factors associated with elevated water temperatures presumably exist for the amphibian species, which have temperature thresholds below those of the fish species. Little is known of the potential impacts of greater daily fluctuations in temperature or colder nighttime and winter temperatures on streams with reduced canopy and aggraded channels. However, it seems likely that this is relatively unimportant compared to increases in temperature especially with the mild climate associated with the Plan Area.

7.2.5.2 Plan Measures and Strategy

7.2.5.2.1 Riparian Management Measures

As noted above, the riparian conservation measures will insure that there will be almost no loss in canopy in the critical inner zone and only minimal short-term effects in the outer zone. As a result, there should be little or no measurable change in water temperature as the result of canopy reduction following timber harvest. Although the sample size is still small, Simpson has direct experimental data to support the conclusion that the proposed riparian conservation measures will prevent impacts to water temperature. A BACI experimental design was used to assess the influence of clearcut timber harvest on water temperature in small Class II watercourses where the influence of reduction of canopy has the greatest potential to impact water temperature (see Appendix C, Class II Temperature Assessments). The riparian protection measures were based on past California FPRs and Simpson's NSO HCP guidelines, which included 50-70 foot buffers with 70% total (overstory and understory) canopy retention. Two of the treated streams showed minor (0.5-1.0 ºC) increases in water temperature within the limits of the harvest unit relative to the controls during the warmest time of day in the warmest 14-day period of the summer and two of the treated streams showed minor decreases (-1.3-1.4 ºC). (The decreases in temperature were likely the result of increased ground water inputs following harvesting of the adjacent stand.) Considering the small magnitude of change under the most extreme annual conditions, opposite direction of the response and the fact that riparian protection measures are going to be substantially increased under the Plan, Simpson believes there should be no measurable change in water temperature in Class I or larger Class II watercourses due to minor reductions in canopy following timber harvest. Even if there continue to be minor positive and negative changes in water temperature in the smaller Class II watercourses, the limited time and area of the impacts should result in no biological effects.

7.2.5.2.2 Slope Stability and Road Management Measures

Simpson's qualitative assessment (review of past air photographs and looking for physical indicators of past conditions such as historical terraces and location of riparian vegetation) of Class I watercourses that are being monitored as part of the long term channel monitoring program (see Appendix D) indicate that streams generally reached peaks in aggradation during the 1960's and 1970's. Since that time, most channels have dramatically downcut and narrowed. More recently, changes in channel morphology has been more subtle, and it is expected that this trend will continue with periodic adjustments due to the severity of winter storms. The long term channel monitoring was designed to detect such minor changes, but the work has not been conducted sufficiently long to quantitatively confirm the average change in stream morphology. With the slope stability and road management measures that are designed to minimize management related sediment inputs, Simpson believes that sediment inputs will be reduced relative to past practices (including not aggressively addressing the potential for road-related mass wasting). Given that water temperatures are generally favorable throughout the Plan Area even with past sediment inputs (see Appendix C), Simpson believes that future sediment minimization measures under the

Plan will further reduce the likelihood that aggradation of channels will result in elevated water temperatures. The only documented cases of sediment inputs causing elevated water temperatures within the Plan Area have been associated with road-related debris flows in headwater streams as noted above. Given the measures under the Plan to locate and treat the legacy of potential threats from roads, Simpson believes that even these isolated impacts will be rapidly diminished as time passes under the Plan.

7.2.6 Potential for Altered Nutrient Inputs

7.2.6.1 Potential for Take and Other Impacts

Salmonid streams throughout the Pacific Northwest and Northern California are thought to be naturally oligotrophic due to low levels of nitrogen (Allan 1995; Triska et al. 1983). In addition, primary productivity of the lower order channels is also limited by light (Triska et al. 1983). Much of the energy and nutrients in lower order channels (where many salmonids rear) comes from allochthonous inputs such as leaf litter. One of the most important sources of detrital inputs in these streams comes from red alder, because it is readily available to the aquatic invertebrate community and its leaves are high in nitrogen (Murphy and Meehan 1991; pers. comm. K. Cummins, Humboldt State University). In contrast to red alder leaves that can be 50% decomposed in less than 2 months, Douglas fir needles may take over 9 months to reach the same level of decay and have far less nitrogen. Woody debris, even twigs and small branches, has limited nutritional value to streams because it decays so slowly and is very low in nitrogen (Murphy and Meehan 1991). Another potentially important source of nutrients to streams comes from annual spawning runs of anadromous salmonids. This has lead to numerous studies looking at the potential benefits of artificially increasing the productivity ("jump-starting") of these systems through the addition of salmon carcasses or other sources of nutrients.

Reduction of riparian vegetation due to timber harvest is likely to increase productivity of streams in several ways. Increased incident solar radiation would likely increase periphyton production (unless it is limited by nitrogen), which may increase the abundance of invertebrates and fish due to an enhanced quality of detritus. The mechanism of this increase is tied to the algae, a higher quality food than leaf or needle litter, which increases the abundance of invertebrate collectors, which in turn, can increase the abundance of predators such as juvenile salmonids (Murphy and Meehan 1991). In addition, timber harvest in riparian areas may reduce the number of conifers and increase deciduous vegetation such as red alder. Therefore, with increased input of nutritionally rich leaf detritus compared to conifer needles, productivity of the stream may increase. Of course, the salmonid response would only be realized if the alteration of the riparian vegetation did not also lead to adversely high water temperatures. An increase in stream productivity may also not ultimately result in increased production of salmonids, because it will primarily benefit summer rearing populations when the "bottleneck" (i.e. limiting factor) for many salmonid streams is winter rearing habitat (Murphy and Meehan 1991).

7.2.6.1.1 <u>Riparian Management Measures</u>

Site-specific data on nutrient levels in streams within the Plan Area is not available, so the assessment of the impact of the conservation measures on current nutrient levels is somewhat speculative and based on general aquatic ecological principles. The riparian conservation measures will favor conifers over hardwoods within the RMZs. The level of harvesting in both the inner and outer zones of all RMZs will maintain the overstory canopy, so that the longer-lived conifers will ultimately tend to replace the short-lived hardwoods. Ultimately, this will reduce the nutrient inputs relative to current levels. However, this will be long process that will extend beyond the life of this Plan, and even then, would not result in the total elimination of hardwoods from the riparian areas. There is the potential for a slight increase in primary productivity due to increased incident solar radiation following timber harvest, which could offset some of the negative effects of increased conifers in the riparian zone. However, the retention of 85% canopy closure in the inner zone and 70% in the outer zone of Class I and IIs, should not allow measurable increases in light reaching the stream. Therefore, although Simpson anticipates an overall very minor decrease in nutrient inputs and productivity over time due to the riparian conservation measures, the change should not be sufficient to impact the Covered Species. In addition, any minor negative impact from loss in nutrient inputs due to an overall decrease in riparian hardwoods throughout the term of the Permits should be more than compensated for by the benefit of LWD from the increased retention of conifers. This is especially true if the limiting factor for many of the Plan Area streams is winter habitat created by backwater areas associated with LWD in the channel.

7.2.6.1.2 Slope Stability and Road Management Measures

Aggradation of channels and scour from debris flows favors recolonization by the more rapidly growing hardwoods such as red alder. Therefore, both the slope stability and road management measures will tend to cause a decline in riparian hardwoods over time and a corresponding decrease in nutrient inputs. However, as noted above, this will be a long and gradual process that will not result in the total elimination of hardwoods. Therefore, Simpson does not anticipate an impact to any of the Covered Species as a result of reduced nutrient inputs.

Future studies in experimental watersheds within the Plan Area will greatly increase Simpson's understanding of the role of nutrients and primary productivity in limiting salmonid numbers in streams throughout the Plan Area. Should it become apparent, pursuant to the experimental watershed studies, that salmonid production is being limited by nutrients or low primary productivity in some or all watersheds within the Plan Area, it is anticipated that Simpson will initiate measures under the adaptive management program to promote greater productivity of its aquatic systems.

7.2.7 Potential for Barriers to Fish and Amphibian Passage

7.2.7.1 Potential for Take and Other Impacts

Culverts installed on fish bearing watercourses may be impassable to both adult and juvenile fish migrating upstream due to 1) high velocities at the inlet, outlet or within the culvert, 2) a high entrance jump into the culvert outlet, 3) shallow water depths, or 4) lack of resting pools at the culvert inlet, outlet, or within the culvert. In addition, such barriers could reduce the availability of low velocity refugia for juvenile salmonids and thereby increase predation and other mortality. The potential effects of these barriers on adults of the fish species include delaying access to spawning habitat or blocking access to spawning habitat and rearing habitat to their offspring.

Culverts that act as barriers could result in take of juvenile salmonids, specifically by causing actual death or injury associated with impairment of essential behavioral patterns: reducing available rearing habitat, reducing or eliminating low velocity refugia during high winter flows, and possibly reducing survival of overwintering juveniles. The impact of such taking could include reductions in survival and production of fish in affected watersheds.

It is not known if culverts have the potential to affect the amphibian species. It is likely that they act as barriers to the larval forms but not the adults. Whether or not this has an impact on the populations is not known since the headwater amphibians are thought to have limited vagility.

7.2.7.2 Plan Measures and Strategy

The conservation strategy includes a measure that will act to reduce and ultimately avoid this type of taking altogether as the Plan is implemented over time.

7.2.7.2.1 Road Management Measures

The Plan addresses fish access issues associated with new roads by installing bridges on fish bearing watercourses where feasible. When a bridge installation is not feasible, a “fish-friendly” structure will be installed that will provide upstream and downstream fish passage. During the road inventory process potential fish passage problems at existing watercourse crossings will be documented and culverts that are impeding fish passage will be prioritized for replacement with a bridge where feasible or other “fish friendly” structure. As the Road Management Measures are implemented over time fish passage problems at watercourse crossings will be eliminated. Rearing habitat and low velocity refugia for the juvenile salmonids will be available. In addition, the “fish-friendly” watercourse crossings will not limit access to upstream spawning habitat for adults and subsequent rearing habitat for their offspring.

7.2.8 Potential for Direct Take from Use of Equipment

In addition to the above indirect potential takings that may result from habitat changes, there are Covered Activities that have the potential to cause two types of direct take of the Covered Species. The first of these types of activities only has the potential to take single individuals or small groups of individuals. These activities include, but are not restricted to the following:

- Operation of heavy machinery in streams during Covered Activities such as construction of watercourse crossings or stream enhancement work (potentially injuring or killing adults, juveniles, larvae, and/or eggs of the species);

- The falling and yarding of timber and pre- and post-harvest management activities (including construction and maintenance of roads) in stands adjacent to streams (possibly injuring or killing the Covered Species).

Other activities that have the potential to directly take the Covered Species could affect larger groups of individuals or whole stream segments. These activities include, but are not restricted to the following:

- Drafting of water from streams for dust abatement (potentially injuring or killing individuals suctioned up with the water and potentially damaging or destroying the incubating eggs of such species);

- Use of petroleum products as fuel and lubricants in machinery and equipment in connection with other Covered Activities (potentially injuring or killing individuals and incubating eggs in the event of incidental drippage or leakage).

7.2.8.1 Plan Measures and Strategy

There are a variety of Road Management and Harvested-Related Ground Disturbance Measures to insure that the Covered Species are not directly taken due to any of the first type of activities described above. However, if some accident did result in direct physical harm in such a manner, it would be an isolated very infrequent event and only affect one or a few isolated individuals. Therefore, Simpson concludes that this form of direct take would not have an impact on the populations of Covered Species.

Although the second type of direct taking has the potential to impact more individuals, a number of Road Management and Harvested-Related Ground Disturbance Measures minimize the risk that such taking will occur. For example, water drafting is not done except under strict guidelines to insure that no Covered Species are accidentally suctioned up with the water or harmed by dewatering of the stream in which they reside. There are also a variety of other measures that limits the proximity of trucks and other heavy equipment near streams. These measures minimize the potential of incidental leakage or drippage from heavy equipment reaching a stream. Best Management Practices governed by other agencies that are outside the scope of this Plan are also designed to insure that accidental spills do not reach any watercourses.

7.3 BENEFITS OF MONITORING AND ADAPTIVE MANAGEMENT

The conservation strategy for this Plan has been the product of field data collection and analysis that began in 1993. A wealth of site-specific data has allowed us to craft a Plan that is designed to effectively and efficiently protect aquatic resources in the context of a managed landscape. Simpson is very confident that this Plan will successfully protect existing aquatic resources that have been shown to be in good condition and allow others to recover that have been impacted from past management or natural disturbance factors. However, Simpson recognizes that additional monitoring and the development of experimental data could provide an opportunity for us to modify the Plan in an adaptive way to make it even more effective, as well as increasing the efficiency through re-allocation of resources associated with the conservation Plan. Simpson does not anticipate that new data will require major adjustments in the Plan, but subtle changes may be necessary as more is learned about these aquatic systems and how they respond to management activities. With the goal of “fine tuning” the conservation measures over time, a comprehensive monitoring and adaptive management component was developed for the Plan that is designed to monitor all of the key factors (response variables) that have the greatest probability to impact (be limiting for) the Covered Species and their habitat. The response variables selected were also chosen because they could be quantified with minimum subjectivity, statistically analyzed and used to modify management in an adaptive manner. In addition, four experimental watersheds have been designated in which scientifically credible BACI experiments will be conducted to further refine Simpson's knowledge of the effectiveness of various aspects of Simpson's conservation strategy.

The overall benefit of Simpson's monitoring and adaptive management program will be to: 1) continuously validate that habitat and populations of the Covered Species are in good condition where it currently exists; 2) document the trend in recovery in areas that have been impacted from past management activities or natural disturbance factors; 3) modify or augment existing conservation measures where "fine tuning" is necessary; and 4) re-allocate resources to make the conservation program more efficient where warranted. In addition to these direct benefits for the conservation of the Covered Species within the Plan Area, Simpson believes the monitoring and experimental studies that are conducted as part of this Plan will further the knowledge of conservation of aquatic species on managed landscapes that will benefit throughout the entire range of those species. Much of the monitoring and proposed research as part of this Plan are new "state of the art" studies that should provide benefits far beyond the scope of the Plan Area.

7.4 SUMMARY OF MITIGATION AND MINIMIZATION OF THE IMPACTS OF TAKING, INCLUDING CUMULATIVE IMPACTS

The impact of the different factors that have the potential to cause take of the Covered Species is highly variable, particularly when considering potential cumulative impacts. In the case of an ITP/ESP, the cumulative effects analysis considers whether the incremental impacts of take, when combined with impacts from other projects, will appreciably reduce the likelihood of survival and recovery in the wild of any Covered Species (this is the ESA "jeopardy" standard); if so, the AHCP/CCAA would fail one of the significant approval criteria for both ITPs and ESPs.

The magnitude and significance of potential cumulative effects were considered, alternatives developed, and specific conservation measures incorporated into the Operating Conservation Program to avoid, minimize or mitigate significant cumulative environmental effects. Where substantial uncertainties remain or multiple resource objectives exist, adaptive management provisions allow for flexible project implementation.

Simpson evaluated cause-and-effect relationships among the Covered Activities, the potential for take of the Covered Species, and the potential impacts of take, including cumulative impacts. Specifically, Simpson analyzed the potential for cumulative effects that could cause take and that result from incidental take in each of the 11 HPAs by examining baseline conditions in each HPA and evaluating the potential for incremental impacts of the Covered Activities and take that results from them to interact in space and time with those conditions to result in or exacerbate any significant negative existing conditions.

As described in Section 5, in each of the HPAs, there are one or more factors that act on different life stages of the Covered Species that have a greater likelihood of limiting the capability of limiting the survival, growth or recovery of resident populations. Simpson's cumulative effects analysis associated with the 11 HPAs identified the most likely limiting factors for the Covered Species in each HPA that could be negatively impacted by the Covered Activities and take that might result from them (Table 7-1). The factors can interact in complex ways spatially and temporally, which make it difficult to know with certainty which factor or factors are actually limiting. However, the conservation strategy is designed to address these limiting factors that could be associated with or exacerbated by Covered Activities so as to minimize and mitigate the impacts of taking (including cumulative impacts), avoid jeopardy and provide significant conservation benefits to the Covered Species.

The Plan is designed to put the greatest effort into addressing factors that are recognized to have the greatest probability to be limiting. For example, Simpson's assessment of the Plan Area indicates that sediment inputs interacting with a general lack of LWD in Class I watercourses have the greatest potential to be limiting within the majority of the Plan Area for all the Covered Species. Simpson's assessment also indicates that the majority of the management related sediment comes from roads, particularly from legacy sites associated with old roads. Therefore, the conservation efforts are focused on preventing management related sediment from entering watercourses with particular attention to removing sediment that is likely to be delivered from roads—without regard to whether that sediment delivery is associated with Simpson's Covered Activities or prior management activities carried out under different regulatory regimes or by different landowners.

The biological need to increase LWD in Class I watercourses is being addressed by a riparian conservation program that maximizes the retention of those trees that not only have the greatest probability of being recruited into the stream, but also have the potential to interact with the fluvial processes of the stream and provide critical summer and winter habitat for the salmonid species.

Although the conservation measures focus on those conditions that are thought to have the greatest likelihood of being limiting in each HPA, the Plan is also designed, as described in the proceeding Sections, to address each of the potential impacts that might cause and result from take of the Covered Species. Simpson designed measures to be implemented during the course of the Plan that will provide for significant improvements in each of the potential limiting factors over baseline conditions in all areas. In other words, with a few exceptions where HPA-specific measures have been proposed, the measures designed to address each type of limiting factor will be applied throughout all 11 HPAs as if that factor is in fact limiting throughout the Plan Area

Through this approach, the incremental impacts associated with take that themselves might not be significant, were analyzed in light of their potential to combine with the impacts of other projects and activities to become significant (i.e., .limiting) in the future. For example, cumulative impacts could result from the spatial and temporal interactions of factors such as water temperature, hydrology, nutrients and barriers to movements with sediment and LWD. The measures in this Plan are designed to minimize the incremental impacts of Covered Activities that could combine with impacts of other projects to cause cumulative impacts.

Table 7-1. Limiting habitat factors for the Covered Species and the relative benefits of the conservation measures for each HPA. (See Section 4.4, for a review of the data supporting these conclusions.)

HPA	Primary Limiting Factor(s)	Covered Species Most Affected	Most Relevant Conservation Measures
Smith River	Lack of LWD resulting in limited rearing habitat (summer and winter) for most salmonids	Primarily the anadromous salmonids	Riparian measures that promote LWD recruitment
Coastal Klamath	General lack of wood and excess sediment (coarse and fine) in some watersheds resulting in limited rearing habitat for salmonids and embedded substrates for amphibians	All of the salmonids and to a lesser extent the amphibians	Riparian management, slope stability, and road management measures
Blue Creek	Lack of LWD resulting in limited rearing habitat for most salmonids	Primarily the anadromous salmonids	Riparian management measures that promote LWD recruitment
Interior Klamath	Excess sediment resulting in embedded substrates and aggraded channels	Primarily tailed frogs and resident salmonids	Road management and slope stability measures
Redwood Creek	Excess sediment resulting in embedded substrates and aggraded channels	Primarily resident salmonids and the amphibians	Road management and slope stability measures
Coastal Lagoons	Excess sediment (mostly fines) resulting in embedded substrates	Primarily cutthroat trout and the amphibians	Primarily road management measures that reduce fine sediment inputs to watercourses
Little River	Excess sediment resulting in embedded substrates and aggraded channels	Primarily the amphibians and the anadromous salmonids	Primarily road management measures
Mad River	General lack of wood and excess sediment (coarse and fine) in some watersheds resulting in limited rearing habitat for salmonids and embedded substrates for amphibians	All	Riparian management, slope stability, and road management measures
North Fork Mad River	Excess sediment resulting in embedded substrates	Primarily the amphibians	Primarily road management measures
Humboldt Bay	Excess sediment inputs from geologically unstable areas resulting in aggraded channels and embedded substrates	Primarily the anadromous salmonids	Slope stability and road management measures
Eel River	Excess sediment inputs from geologically unstable areas resulting in aggraded channels and embedded substrates	Primarily the anadromous salmonids – there are few salmonids and no known amphibian populations in this HPA	Road management and slope stability measures, but the limited numbers of covered species in the HPA would put it at the lowest priority

Significantly, Simpson believes that, as designed, the Plan provides for a significant improvement in the habitat of Covered Species during the Plan period. In particular, the road conservation measures will provide for a significant acceleration of recovery of stream conditions negatively impacted by sediment in the first fifteen years of the Plan. Other measures will provide similar improvements of habitat conditions.

Simpson's activities and management practices under the Operating Conservation Program outlined in Section 6.2 of the Plan will result in significant improvements in habitat conditions for the species. In Simpson's view, the Plan contributes to the maintenance and restoration of properly functioning habitat and, thereby, contributes to the recovery of the listed Covered Species.

Based on this analysis, Simpson believes that this Plan will not only minimize and mitigate the impacts of taking and contribute to conservation efforts for ESP Species, but, by providing measures that address the above-discussed potential limiting habitat factors, will not have a negative cumulative effect but instead will have a cumulative benefit for all Covered Species and their habitats in that portion of the Plan Area in each of the HPAs. The Plan will contribute significantly to the development and maintenance of properly functioning habitat and thereby contribute to the recovery of the listed species. With respect to the unlisted species, the habitat improvement benefits projected to result from this Plan, in addition to other measures that minimize and mitigate the impacts of incidental take, will contribute to efforts that, when combined with the benefits that would be achieved if conservation measures also were implemented on other necessary properties, would preclude or remove the need to list the ESP Species in the future. In other words, this Plan is designed expressly to exceed the requirements for HCPs and to meet the requirement for CCAAs (that a CCAA must contribute to efforts to reduce the need to list currently unlisted Covered ESP Species by providing early conservation benefits to those species).

7.5 BENEFITS OF THE CONSERVATION MEASURES FOR THE ESP SPECIES

As discussed above, the Plan covers three ITP species (coho and chinook salmon and steelhead) and four ESP species (resident rainbow trout, coastal cutthroat trout, tailed frog and southern torrent salamander). Included in the CCAA/ESP approval criteria is a requirement that the Plan provide conservation benefits to the Covered Species that, when combined with those benefits that would be achieved if it is assumed that the conservation measures were also implemented on other necessary properties would preclude or remove any need to list the Covered Species. This subsection summarizes the Plan's particular conservation benefits for the ESP species.

Both the ITP and ESP Species are covered in this Plan, because the best available scientific data and site specific information discussed in Sections 3, 4, and 5 and Appendix C indicate that all of the species are sensitive to the same general suite of potential impacts. Therefore, the conservation measures designed to minimize and mitigate those potential impacts and enhance the species' habitats will generally benefit all of the Covered Species. However, the ESP species generally occur in smaller streams and higher in the watershed relative to the ITP species (see Section 3). The ESP species also are not anadromous with the exception of some populations of coastal cutthroat trout and the occasional resident rainbow trout that becomes anadromous. If there are conservation measures that primarily benefit the larger tributaries lower in the watershed, they would have relatively little benefit for the ESP species. However, our assessment of potential impacts to the larger tributaries lower in the watershed was based on the premise that off-site or cumulative factors from higher in the watershed were primarily responsible for conditions in the lower watersheds. As a result, none of the conservation measures were developed to benefit either group of Covered Species exclusively. Nevertheless, there are differences in the ecology, life history requirements, and Plan Area distribution of each Covered Species that create subtle species-specific interactions between potential impacts and the conservation measures designed to minimize and mitigate those impacts and maintain and improve the species' habitat.

In general, the Plan's conservation measures were developed based on the concept that if sufficient protection is provided for the most sensitive of the Covered Species, the other less sensitive species will also be protected adequately even though there are subtle differences in how the individual species respond to the conservation measures.

7.5.1 Coastal Cutthroat Trout and Resident Rainbow Trout

Coastal cutthroat trout and resident rainbow trout are well distributed throughout the coastal portions of the Plan Area with the exception of the coastal cutthroat trout in the southern-most HPA (Eel River), which is south of the range of the species. Although the presence of coastal cutthroat trout and resident rainbow trout populations has been well documented, Simpson has little direct evidence of their abundance and population status. The tendency for coastal cutthroat and resident rainbow trout to occur as resident populations, often upstream of barriers to anadromy, make their population levels more directly correlated to local conditions in a given watershed or sub-basin relative to the anadromous salmonids. The fact that most of the coastal streams in the Plan Area still have resident populations of coastal cutthroat and resident rainbow trout despite all of the watersheds having been harvested at least once with little or no protection of riparian habitat suggests that these fish populations are relatively resilient and unaffected by disturbance. A study in British Columbia compared coastal cutthroat trout densities in a pristine stream reach to reaches harvested with no riparian buffers, but with different levels of LWD and logging slash retained (Young et al. 1999). The harvested stream reach with LWD and logging slash removed showed an initial decline in coastal cutthroat densities that recovered to greater than reference levels in 9 years after LWD was added to the reach. The harvested stream reach with LWD and logging slash retained showed no change in coastal cutthroat densities relative to the reference reach. In another study of the response of coastal cutthroat trout populations to timber harvesting activities in the western Cascades of Oregon, Moore and Gregory (1988) reported that the highest growth rates of coastal cutthroat were in hardwood dominated stream reaches approximately 40 years after harvesting. Coastal cutthroat in open stream reaches that had been recently clearcut and pristine old growth streams had similar growth rates. Presumably resident rainbow trout would have a similar response to timber harvesting activities as coastal cutthroat trout populations; but there have been no specific studies that have examined these effects on the resident form of the rainbow trout.

The different conservation measures (riparian management, slope stability, harvest-related ground disturbance, and road management) were designed to maintain cool water temperatures and stable riparian micro-climates, allow for the recruitment of LWD and minimize management-related sediment input. The measures were designed to protect the most sensitive of the Covered Species (generally thought to be coho salmon). Therefore, coastal cutthroat trout and resident rainbow trout populations should be equally protected. Subtle differences in the conservation benefits for the coastal cutthroat trout and resident rainbow trout probably relate to their preference for generally smaller and colder coastal tributaries relative to the other salmonids covered in the Plan. Given that the Plan Area streams are at or near the southern limits for coastal cutthroat trout, the riparian measures designed to maintain and improve cold water temperatures are likely to provide the most critical benefit for this species.

7.5.2 Tailed Frog

Unlike the anadromous salmonids, the headwater amphibians, which include the tailed frog and southern torrent salamander, live their entire lives in or near headwater streams. As a result, populations of these species are totally dependent on local conditions in the watershed. Tailed frog habitat has been characterized as perennial, cold, fast flowing mountain streams (generally larger Class II and small Class I watercourses) with dense vegetation cover (Bury 1968, Nussbaum et al. 1983). To support larval tailed frogs, streams must have suitable gravel and cobble for attachment sites and diatoms for food (Bury and Corn 1988). Tailed frogs are well distributed throughout the Plan Area except for geologically unconsolidated areas. Previous studies done within the Plan Area determined that 75% of all streams (80% excluding geologically unsuitable areas) across the Plan Area had tailed frog populations (Diller and Wallace 1999). This occurrence rate is similar to the highest reported for the species even in pristine conditions (Corn and Bury 1989; Welsh 1990; Bull and Carter 1996). Currently, there are 283 streams known to support tailed frogs throughout the Plan Area, which is the majority of known sites in California. The abundance of tailed frogs in individual streams has only been estimated for a limited number of streams associated with the headwaters monitoring, so it is not possible to characterize abundance across the Plan Area. In addition, there are no comparable estimates of tailed frog abundance from other regions to which Plan Area populations can be compared. However, qualitative comparisons suggest that some of the populations of tailed frogs in the Plan Area are equal or greater than any populations studied.

Headwater areas in the Plan Area have been harvested at least once, many with little or no protection for streams or unstable areas. The distribution and abundance of tailed frogs, despite the previous lack of protection, suggest that they are relatively resistant to the impact of past timber harvesting in this region. Apparently, the primary impact of past timber harvesting on tailed frogs was to restrict their occurrence to higher gradient stream reaches that were less likely to be embedded with fine sediments (Diller and Wallace 1999). Presumably, tailed frog populations declined following extensive past unregulated harvesting but were able to survive in or recolonize the higher gradient stream reaches. Subsequent to the massive impacts of unregulated harvesting, these streams have generally recovered, except for some of the lower gradient reaches that still have higher levels of fine sediments and embeddedness.

The conservation measures that are designed to minimize management related sediment inputs (e.g. Road Management and Slope Stability Measures) will likely have the greatest benefit for tailed frogs. Observations as part of previous habitat association and life history studies (Wallace and Diller 1998; Diller and Wallace 1999) and ongoing tailed frog monitoring suggest that fine sediment inputs which cause embeddedness of the substrate (generally sand-sized particles) have the greatest impact on larval tailed frog populations. This impact is particularly apparent downstream of watercourse crossings that are hydrologically connected to a Class II watercourse. In addition, failed log-stringer bridges, Humboldt crossings and culverts have been known to trigger debris torrents that have dramatic immediate, but short-term, impacts on larval populations and stream habitat.

Observations of debris torrents that destroyed stream-side vegetation and exposed the stream to direct solar radiation indicate that the impact on larval tailed frog populations was relatively ephemeral. Immediately following denuding of streamside vegetation, water temperatures increased and excessive growth of filamentous green algae excluded larval tailed frogs. However, after 2-3 years, recovery of vegetation such as alder and willows allowed water quality to recover sufficiently so that larval tailed frogs could recolonize the site. Based on these observations, Simpson concludes that the maintenance of shade and micro-climate as part of the riparian conservation measures are relatively less important to larval tailed frogs compared to sediment inputs. However, there are no direct observations on how modification of the riparian micro-climate may affect the “adult” (all metamorphosed age classes) frogs. In the terrestrial stage, tailed frogs are strictly nocturnal and night-time observations as part of a new mark-recapture study of the adult population indicate that they are commonly found in relatively xeric sites. This suggests that the adult population is relatively insensitive to changes in micro-climate, but direct evidence is still lacking.

The input of LWD from the RMZs is likely important to sort and meter sediment in the channel and create suitable habitat for larval tailed frogs. However, the value of LWD for cover and pool formation is probably relatively unimportant for tailed frogs compared to the salmonids, because the larval frogs select for riffle habitat and avoid pools. Amphibian studies throughout the Plan Area indicated that many Class II watercourses received large amounts of LWD as the result of past unregulated timber harvesting and this LWD was generally not removed from these channels. Therefore, in contrast to most Class I watercourses, the Class IIs in the Plan Area are generally not deficient in LWD and may actually have greater than normal amounts. In summary, LWD recruitment is likely an important component of the riparian function for tailed frogs, but it is not likely to be currently limiting. Further, LWD recruitment should be maintained and enhanced in the future by the riparian conservation measures.

7.5.3 Southern Torrent Salamanders

Southern torrent salamanders generally exist in seeps and springs and the uppermost headwater streams (Nussbaum et al. 1983; Stebbins 1985). They are a small salamander that appears to spend most of its time within the interstices of the stream’s substrate, which make them difficult to locate and capture without disturbing their habitat. The larvae have gills and are restricted to flowing water while adults also appear to spend most of their time in the water, but are capable of movements out of the water. They are thought to have limited dispersal abilities and small home ranges so that recolonization of extirpated sites may take decades (Nussbaum and Tait 1977; Welsh and Lind 1992; Nijhuis and Kaplan 1998). Given the highly disjunct nature of their habitat, individuals at a given site would constitute a sub-population and are likely to be isolated from other adjacent sub-populations. The degree of isolation of these sub-populations probably varies depending on the distance and habitat that separate them, so that torrent salamanders could be best described as existing as a meta-population.

They are well distributed throughout the Plan Area except for geologically unconsolidated areas. Previous studies done within the Plan Area estimated that 80% of all streams (almost 90% excluding geologically unsuitable areas) across the Plan Area had torrent salamander populations (Diller and Wallace 1996). This occurrence rate is similar to the highest reported for the species even in pristine conditions (Carey 1989; Corn and Bury 1989; Welsh et al. 1992). Currently, there are 598 known torrent salamander sites (sub-populations) throughout the Plan Area, which is the majority of known sites in California. Due to the survey difficulties associated with this species, there are no reliable estimates of abundance for any of these sub-populations, and there are no estimates available from other areas for comparison. However, the number of individuals that can potentially be found during any given survey varies from several individuals up to a 100 or more.

As noted above for tailed frogs, almost all headwater areas in the Plan Area have been harvested at least once, many with little or no protection provided at the time for streams or unstable areas. This is particularly true for the seeps, springs and small headwater streams in which torrent salamanders are found. The distribution of torrent salamanders, despite the previous lack of protection, suggests that they are relatively resistant to the impact of past timber harvesting in this region. Because they occur in small relatively isolated patches of habitat, torrent salamanders are primarily vulnerable to potential direct impacts from timber harvest (Diller and Wallace 1996). Direct impacts could include activities such as excessive canopy removal at the site leading to elevated water temperature, operating heavy equipment in the site, or destabilizing soil leading to excessive sediment deposits at the site. Past observations have indicated that these direct impacts can lead to extinction of a sub-population at a site. However, given their limited ability to recolonize sites and current extensive distribution throughout the Plan Area, most populations of torrent salamanders must not have gone extinct following extensive past unregulated harvesting. Presumably populations declined, but apparently there were sufficient refugia to allow the populations to persist. Diller and Wallace (1996) noted that torrent salamanders were restricted to the highest gradient reaches in streams that were heavily impacted from past timber harvesting activities. They hypothesized that high gradient reaches were important because they were transport areas where finer sediments did not accumulate and gravel and cobble did not become embedded. Subsequent to the impacts of unregulated harvesting, these streams have generally recovered except for the lower gradient reaches that still have high levels of fine sediments and embeddedness. It is likely that in most streams in the Plan Area, habitat probably existed further downstream in lower gradient reaches prior to timber harvest but was reduced or eliminated by the accumulation of sediments. In summary, Simpson concludes that past unregulated and less regulated timber harvesting practices caused a reduction in the number of individuals in most headwater streams in consolidated geologic areas, but probably did not often cause the total extinction of populations in a stream, because virtually all streams in our study area have some high gradient reaches.

One of the greatest conservation benefits provided by Simpson's conservation measures for southern torrent salamanders is Simpson's emphasis on identifying, and improving its ability to identify and thereby protect, the small and often isolated patches of habitat in which the species can be found. Simpson has an ongoing program to field train foresters to recognize habitat for the species. Field studies and monitoring across the Plan Area indicate that populations of southern torrent salamanders have a high probability of persisting following timber harvesting, if their habitat is recognized and direct impacts avoided.

There are certain situations where indirect effects from timber harvesting activities do impact southern torrent salamanders. The most common indirect impact on salamander populations observed in the Plan Area is related to fine sediment inputs (particularly sand-sized particles) from offsite roads that enter headwater streams. (Seeps and springs are generally not impacted by roads, because roads are located to avoid such wet areas.) These fine particles fill the interstices in the stream's gravel and cobble substrates and eliminate the refuge sites for the salamander. Differences in the abundance of salamanders and the stream's substrate above and below hydrologically connected watercourse crossings provide strong evidence for the potential negative impact of roads on habitat for the species. Based on this observation, provisions in the Road Management Measures that provide for hydrologically disconnecting roads from watercourse crossings will provide significant benefits to southern torrent salamanders.

Failed log-stringer bridges, Humboldt crossings, and culverts have the potential to deliver large amounts of sediment and destroy habitat for torrent salamanders, but typically these failures occur lower in the watershed in stream reaches primary occupied by tailed frogs and Pacific giant salamanders. Most of the uppermost stream reaches occupied by torrent salamanders are too small to generate sufficient energy to cause a road failure. As a result, removal of these potential sediment sources as part of road decommissioning and upgrading will likely have relatively little direct benefit for torrent salamanders.

Headwater seeps and springs, where torrent salamanders are particularly abundant, are often associated with headwall swales and at the heads of landslides. During the natural cycle of these geologic features, the headwall swales gradually fill with colluvium and eventually fail producing a shallow rapid landslide or debris torrent that scours the feature down to bedrock. This phenomenon has been observed in a variety of sites across the Plan Area, and the best habitat for torrent salamanders appears to occur relatively soon after a failure (probably 10-20 years) when the feature is only partially filled with loose colluvium from a consolidated geologic formation. Unsorted colluvium that is angular and of mixed sizes provides particularly good habitat because of the extensive interstitial network through which the salamanders can move. In general, shallow rapid landslides in consolidated geologic formations do not appear to result in a net harm to torrent salamanders, because new habitat is created as other sites are temporarily destroyed. (This relationship does not hold in regions with unconsolidated geologic formations, because torrent salamanders are not found in these areas.) This observation is corroborated by the high density of torrent salamander sites in regions (e.g. Hunter and Terwer Creeks) with unusually high densities of shallow rapid landslides. Based on these observations, Simpson does not believe that the slope stability conservation measures will have much direct benefit for southern torrent salamanders.

The riparian conservation measures will benefit southern torrent salamanders because they prevent heavy equipment to directly impact the habitat for the species. Maintenance of cold water and a cool riparian micro-climate also would appear to be important, because the species is known to have very limited thermal tolerance (Welsh and Lind 1996). However, Simpson has documented literally hundreds of torrent salamander sites that have been clearcut in the past and the salamanders have persisted. (The limited vagility of the species would rule out recolonization in most of these sites.) Our explanation for this phenomenon is based on the ameliorating cool coastal climate throughout much of the Plan Area and the ability of the salamanders to persist at the interface where ground water first emerges on the surface. Being an ectothermic animal that is relatively long lived, individuals could probably persist for several years until the regrowth of vegetation provides for more suitable stream conditions. Therefore, the riparian conservation measures are probably not critical to allow for persistence of the species in many of the more coastal regions of the Plan Area, but the RMZs on small headwater streams will allow for more stable populations that will be able to occupy a more extensive portion of headwaters streams. In the more interior portions of the Plan Area with greater temperature extremes, the RMZs are probably critical for maintaining cool water temperatures and riparian micro-climate.

The LWD provided from the RMZs is probably of limited direct benefit to southern torrent salamanders. A study of habitat associations for torrent salamanders in the Plan Area (Diller and Wallace 1996) indicated that woody debris can be important to the species, but relatively small wood was functional in these small headwater streams. Broken branches and dead saplings are the size of wood that most commonly creates sediment traps in which torrent salamanders seek refuge in these small streams. In addition, leaf drop and small woody debris (allochthonous inputs) are vital in these streams to fuel the detrital trophic system. Therefore, Simpson concludes that the large wood that is so important in many of the salmonid stream reaches is of relatively less importance to southern torrent salamanders. However, smaller size woody input from the trees growing in the RMZs of headwater streams still provides a vital benefit to southern torrent salamanders.

7.6 CONCLUSIONS REGARDING MITIGATION OF IMPACTS, PROVISION OF CONSERVATION BENEFITS, AND AVOIDANCE OF JEOPARDY

As explained above, each of the potential impacts discussed above and summarized in Section 5, including cumulative impacts, will be minimized and mitigated to the maximum extent practicable. Although any particular type of impact or potential limiting factor may not be significant in a particular HPA or watershed in the Plan Area, the AHCP/CCAA addresses each type of potential impact or potential limiting factor as if it is significant individually and is the "bottleneck" for the local population of each of the Covered Species. In addition, the operating conservation program as a whole addresses the potential impacts and limiting factors collectively so as to ensure that Simpson's Covered Activities pursuant to the operating conservation program will minimize and mitigate all individual and cumulative impacts to the maximum extent practicable and will contribute to conservation efforts benefiting the ESP (as well as the ITP) Species.

Furthermore, the Plan includes an extensive monitoring and adaptive management program that provides mechanisms to adjust the conservation measures as appropriate to provide further assurances that the AHCP/CCAA will meet the statutory and regulatory criteria described above. Under these circumstances, any incidental take of Covered Species is not expected to appreciably reduce the likelihood of survival and recovery of any of the Covered Species in the wild.

Finally, the individual conservation measures and the operating conservation program as a whole are projected to provide significant net benefits to the Covered Species and their habitats over the term of the Permits. These benefits include maintaining and improving properly functioning habitat and related environmental conditions that may have been negatively impacted under previous regulatory and management regimes. The conservation program will contribute to the recovery of the listed Covered Species and to conservation efforts intended to preclude or remove a need to list the unlisted Covered Species in the future.